Exhibit 2

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

GARY KOOPMAN, TIMOTHY KIDD and VICTOR PIRNIK, Individually and on Behalf of All Others Similarly Situated,

Plaintiffs,

v.

FIAT CHRYSLER AUTOMOBILES N.V., FCA US LLC, SERGIO MARCHIONNE, RICHARD K. PALMER, SCOTT KUNSELMAN, MICHAEL DAHL, STEVE MAZURE AND ROBERT E. LEE

Defendants.

Civ. Action No: 15-cv-07199-JMF

CLASS ACTION

EXPERT REBUTTAL REPORT OF DR AXEL FRIEDRICH

October 26, 2018

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I. Background and Qualifications

1. Previously in this matter, I have submitted an expert report dated August 15, 2018 (the "Friedrich Report").

2. In the Friedrich Report I opined that, based on my review of the available evidence in this matter and careful analysis of relevant regulations, and as more fully discussed below, I conclude that

i. FCA was not in compliance with the EU emissions regulations during the Class Period.

ii. FCA's statements concerning its compliance with emissions regulations were false and misleading.

3. I provided expert testimony in this matter on September 14, 2018. My qualifications are contained in ¶1 to the Friedrich Report. My curriculum vitae, which includes my academic research, publications in the past ten years, and prior expert testimony in the past four years, is attached as Exhibit 1 to the Friedrich Report.

II. Scope of Engagement

4. I now have been asked by Class Counsel to reply to the claims in the Rebuttal Report of Nicholas Molden dated September 26, 2018 (the "Molden Report").

5. My opinions are based upon my professional knowledge and experience, my review of documents and information relevant to this matter, and the analyses described in this Report and its Exhibits. Documents, data, and other information that I have relied upon as bases for my opinions are cited in this Report and its Exhibits, as well as in the Friedrich Report.

III. Bases for Opinion

6. Class Counsel have informed me that the record in this matter continues to be developed. I expect to review additional facts that may become available through discovery as well as the reports and depositions of other expert witnesses. The opinions offered in this Report are subject to refinement or revision based on continuing analysis of the documents and information listed above,

as well as new or additional information that may be provided to or obtained by me in the course of this matter.

IV. Emissions Regulations in the European Union

7. The Molden Report includes a brief discussion of the European Union documents related to emissions standards, including nitrogen oxides ("NOx") from light duty diesel vehicles. Mr. Molden discusses the use of the terms "engine", "defeat device", "normal use", and "engine damage" and complains that these terms are "vague". However, his discussion ignores many important factors, including some cited in my initial report, that clarify the meaning of these terms. Overall, Mr. Molden ignored the purpose of E.U. Commission Regulation (EC) No. 715/2007 ("EC 715/2007"). The purpose of that regulation is to implement Euro 5 and Euro 6 standards for emissions of pollutants such as NOx *in the real world* and not merely in tests.[1] Therefore, it makes no sense to read the regulations in such away that they allow real world emissions that vastly exceed tested emissions.

8. The Molden Report claims, at ¶26, that the term "engine" in EC 715/2007 is unclear. This ignores the fact that this the term is clarified in another regulation. Directive 2007/46/EC of the European Parliament and of the Council of 5 September 2007 provides detailed reporting requirements for manufacturers in order to obtain approval from their respective regulatory authorities. This Directive clearly designates what components are considered part of the engine.

9. The Molden Report also claims, at ¶29, that the definition of defeat device is vague because "the regulations" do not define "normal use" and there is no general consensus as to its meaning. However, this fails to acknowledge that the term "normal use" is used throughout EU regulations, including regulations relating to safety standards for brakes, as set forth in my opening report.[2] In addition, Mr. Molden cites the report by the Kraftfahrt-Bundesamt ("KBA Report") to suggest that the term "normal use" is so vague as to be useless but fails to acknowledge that the KBA Report also identifies several vehicles that used emissions reduction strategies that "reduce[] the effectiveness of

[1] EC 715/2007, preamble, para 4.
[2] Friedrich Report ¶47, 98/12/EC.

the emission control system under conditions that are to be expected under in normal vehicle operation and use."[3] He also ignores that, subsequent to the KBA report, the German Ministry of Transportation did determine that three Fiat vehicles contain illegal defeat devices.[4] Moreover, according to the report by the International Council on Clean Transport, cited in the Molden Report, notes that several manufacturers have disclosed that the emissions control system reduces the effectiveness of the EGR system when ambient temperature falls below 17 °C (62.6 degrees), and by any reasonable definition, such temperatures constitute "normal use" because the average temperature is below that level in Paris 83% of the time and in London 75% of the time.[5] This defeat device is commonly referred to as a "thermal window". FCA also used vehicles that deployed such a strategy, except that in FCA's vehicles, in some cases a 19°C thermal window was used.[6] Though not binding in Europe, I note that the US EPA has specifically stated that temperatures of up to 100°F should be considered part of normal use.[7]

10. Mr. Molden argues that because the term "engine protection" is not defined, this exception to the regulation is so vague that in all cases, the presence of an illegal defeat device is "ambiguous."[8] What Molden ignores in his report, however, is that even if there is some ambiguity at the margin, this is not an ambiguous case. As stated above, FCA engines that included a "thermal window" caused the EGR to reduce operation at temperatures as high as 19 °C, and therefore the defeat device would be operating 80% of the time in middle European climate countries.[9]

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[3] Rep. by the "Volkswagen" Comm. of Inquiry, Fed. Ministry of Transp. and Digital Infrastructure, at 122 (April 2016) [hereinafter "KBA Report"]

[4] https://www.forbes.com/sites/bertelschmitt/2017/02/07/fca-referred-to-french-prosecutor-on-dieselgate-charges/#4b76c8d83dce

[5] Int'l Council on Clean Transp. [ICCT], Defeat Devices under the U.S. and EU Passenger Vehicle Emissions Testing Regulations, at 10 (March 2016).

[6] https://greencarmagazine.de/ich-schalt-dann-mal-ab-thermofenster-zur-motorsteuerung-im-dieselmotor/; *See also* Freidrich Report at ¶56

[7] Letter, United States Environmental Protection Agency, VPCD-98-13, October 15, 1998.

[8] Molden Report ¶24.

[9] https://greencarmagazine.de/ich-schalt-dann-mal-ab-thermofenster-zur-motorsteuerung-im-dieselmotor/

V. The Molden Report Misconstrues the Effectiveness of Emissions Testing to Identify Defeat Devices

11. Mr. Molden's claim that emissions testing alone cannot establish the existence of a defeat device misconstrues my report and lacks a scientific basis. While it is generally true that factors other than defeat devices might cause increased emissions under some circumstances, it is also possible to design emissions tests that rule out those other factors. For example, as Mr. Molden correctly notes in ¶33 of his report, when an engine is started from a cold condition, a diesel engine will naturally generate more NOx until the engine warms up, typically 32% higher according to his own testing, which accords with my experience.[10] Therefore, if an engine emits substantially higher NOx in a warm condition than a cold condition, that is evidence of a defeat device. Mr. Molden's own company's emissions testing showed that the FIAT 500X has emissions 17 times higher emissions in a warm test than from a cold start, which shows the presence of a defeat device.

12. Mr. Molden notes that maintenance issues could cause increased emissions levels.[11] This is true in general but easy to rule out in practice. All of the vehicles under discussion are certified under Euro 5 or Euro 6 standards and therefore must include an On Board Diagnostic ("OBD") system. The OBD system would recognize an engine issue and illuminate a dashboard light. No competent emissions tester would fail to verify that the OBD lights showing maintenance issues are off prior to conducting testing, and in all tests that I have performed, we performed such verification.

13. Mr. Molden also points out that Euro 5 and Euro 6 diesel vehicles are equipped with a diesel particulate filter.[12] Mr. Molden is generally correct that these filters typically undergo regeneration cycles which cause elevated NOx levels. However, as Mr. Molden notes, this can be identified and factored out by identifying elevated exhaust temperature that coincides with the regeneration cycle.[13] Mr. Molden claims in some cases a regeneration cycle will not show elevated exhaust temperatures, but this is wrong as a matter of simple physics as the combustion of the stored carbon increases the

[10] Molden Report ¶33.
[11] Molden Report ¶32.
[12] Molden Report ¶34.
[13] *Id.*

exhaust temperature. But even if this were true there is another parameter to detect regeneration: CO_2 emissions. This shows simple chemistry: During the regeneration cycle soot is burned and CO_2 emissions are increased, which are also measured in standard tailpipe emissions tests.

14. Mr. Molden also notes that NEDC laboratory results can be artificially low due to "allowances and tolerances".[14] Again, this is generally true but cannot account for emissions increases in real world driving conditions shown in testing of Fiat Vehicles. Indeed, Mr. Molden himself noted that his company, Emissions Analytics, tested Fiat engines and "found that Fiat's 500X MultiJet with a 1.6-litre diesel engine, emitted 14 times above EU and UK limits. The Fiat Doblo van was even worse, with emission 17.8 times above the legal limit, even though it has passed official tests."[15] And even Mr. Molden acknowledged that "When a vehicle passes laboratory tests but shows such a different performance on the road you have to be suspicious about the technology."[16] In addition, this issue is not a factor at all in a warm start emission test, where the same dynamometer settings are used as in the cold start test. The emission in the warm start test are much higher than in the cold start emission test as a number of emission test of FCA vehicles show.

15. Mr. Molden claims, in Paragraph 36, that emissions can be increased as a result of accelerating the car to a high speed, which Mr. Molden claims is a non-defeat-device related cause for higher emissions in on-road tests. However, what Mr. Molden ignores is that diesel engines generally do produce more NOx at higher speeds, a fully operational emissions control system would abate most of this increased NOx. Therefore, high speeds cannot explain the discrepancy seen in the tests. Moreover, an unusually large emissions spike at higher speed would be an indication that the emissions controls are not fully operational.

16. Mr. Molden also notes, in Paragraph 36, that reduced weight during the NEDC laboratory tests can lead to lower emissions, which is, again, generally true but not relevant here. The effect size of this phenomenon is small and cannot account for the large discrepancies found in my report and by

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[14] Molden Report ¶35.
[15] https://www.emissionsanalytics.com/news/the-sunday-times-uk-approved-fiats-dirty-diesel-engine
[16] *Id.*

Emissions Analytics' own testing. I note, for instance, that Emissions Analytics' EQUA Air Quality Index, which provides a rating for vehicles based on real-world emissions testing, found that four Fiat Diesel Vehicles tested showed emissions at least 6 times higher than are acceptable under the Euro 6 standard, with two vehicles showing emissions in excess of twelve times Euro 6 standards.[17]

17. Mr. Molden claims that I did not consider whether any of the defeat device exceptions are applicable. This is false, I considered the exceptions and came to the conclusion that they are not applicable. As I noted in my initial report, other manufacturers are able to meet NOx standards for diesel vehicles in on road settings with technology that Fiat could have bought from third party suppliers such as Bosch or catalyst manufacturers such as Johnson Matthey.[18] I note that Molden acknowledged in his deposition that meeting the legal emissions limits in real world driving is technically feasible.[19]

18. Mr. Molden also notes that I did not have any direct discussions with Fiat regarding their potential justifications for the defeat devices.[20] This is accurate, but irrelevant, because I was able to review the justifications provided by Fiat to the various European regulators whose reports I cited.

19. Mr. Molden's statements that "none of the regulator reports relied on by Dr. Friedrich concluded that FCA was not in compliance with E.U. regulations" is misleading.[21] After the KBA Report was released, "Germany's Ministry Of Transport declared that Fiat Chrysler has used illegal defeat devices in at least three models, Fiat's 500X, Fiat Doblo and Jeep Renegade.[22] Similarly, French investigators referred Fiat to prosecutors for possible prosecution due to the results of its diesel emissions investigation.[23] The RDW Report also explains that after conducting emissions testing and

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[17] https://equaindex.com/equa-air-quality-index/.
[18] Friedrich Report ¶153.
[19] Transcript of Deposition of Nicholas Molden, 158:3-159:10.
[20] Molden Report ¶44.
[21] Molden Report ¶51
[22] https://www.forbes.com/sites/bertelschmitt/2017/02/07/fca-referred-to-french-prosecutor-on-dieselgate-charges/#4b76c8d83dce
[23] *Id.*

interviewing FCA, it made a referral to the Dutch Public Prosecution Service for potential criminal prosecution.[24]

20. I also note the fact that Mr. Molden did not discuss my analysis of the findings of Holz et. al., which found defeat devices in the software of an FCA vehicle. I understand from Mr. Molden's deposition transcript that he did not believe he was competent to evaluate it.[25] Given that he was unable to properly evaluate all the evidence I relied on, he had no basis to reach a conclusion that my report failed to demonstrate that FCA used illegal defeat devices.

VI. CONCLUSION

21. As set forth above, the Molden Report's conclusion that I failed to show a defeat device is unwarranted by the evidence he provides. Mr. Molden cannot explain how the test results I cited in my report could be explained by anything other than a defeat device. Emissions Analytics' own test provides the same result. He also simply ignores the fact that the defeat devices cannot fall within the engine protection exception because other manufacturers were able to produce cars that did not require these defeat devices for engine protection.

[24] https://www.rdw.nl/-/media/rdw/rdw/pdf/sitecollectiondocuments/over-rdw/rapporten/rdw-emission-test-programme-english.pdf. p. 4.
[25] Transcript of Deposition of Nicholas Molden,

I declare under penalty of perjury that the foregoing is true and correct.
Executed on October 26, at Berlin, Germany.

Axel Friedrich

Dr. Axel Friedrich